ROTATING, SITTING-UP BED COMPRISING A THIGH-RAISING DEVICE

From DE 102 00 408 C1, a rotating bed is known which is designed to bring a patient lying in the bed into a sitting position at the edge of the bed. For this purpose, the known bed has a height-adjustable base, which carries a rotating articulated element at its head. The support or mattress frame is connected to the base by means of the rotating articulated element and can be rotated from the normal bed position, in which the longitudinal axis of the mattress frame coincides with the longitudinal axis of the bed, into a cross-wise position.

The support frame is assembled from several sections, so that it can be folded like a Z into a chair or recliner shape in the cross-wise rotated position. In the chair or recliner shape, the support frame forms a backrest, a sitting surface, and a section which hangs downwards and which is used for supporting the lower legs in the bed position. The sitting surface itself has, in turn, two parts, and comprises a center part connected rigidly to the swivel articulated element and a thigh part, which is hinged to this center part and which is inserted between the center part and the lower leg part.

In the sitting position for the known bed, the center part and the thigh section extend completely horizontal in the sitting position. The mattress, which has a considerable thickness, is pulled over the edge between the thigh part and the lower leg part in the chair or recliner position, with this producing a falling "chair edge." This is not bothersome in the known rotating bed, because the sitting depth is chosen to be relatively large. Decreasing the sitting depth would mean the patient would feel unsafe in a sitting position, especially if a mattress made from viscose foam is not used.

Starting from this background, the object of the invention is to create a sitting-up bed that does not make the patient feel unsafe in the sitting position even for reduced sitting depths.

This object is achieved according to the invention with the rotating and sitting-up bed with the features of Claim 1.

In the novel sitting-up bed, use is made of the fact that the thigh part is connected to the center part by means of a hinge. In the sitting position, the seat area of the patient lies approximately above the center part while the thigh up to the back of the knee lies on the

thigh part. Furthermore, there are means to further lift the thigh part somewhat in the vicinity of the back of the knee in the recliner or chair position. In this way, the center part forms a flat depression together with the thigh part. This depression position remains even when mattress material is used that is not suitable for generating a corresponding depression, and thus a corresponding feeling of safety in the sitting position.

The resulting flat sitting depression, which is bounded behind the patient by the back part, enables the distance between the bend at which the back part transitions into the sitting surface, to the bend where the sitting surface is bent downwards at the front edge, to be shortened, without making the patient feel unsafe in the sitting position. On the other hand, the shortened sitting surface considerably simplifies patient transfer from the bed to a wheelchair for the care provider, and without additional mechanical aids.

Patients who can still stand up themselves when they are brought into the sitting position by the bed also benefit from the shortened sitting surface, which simplifies standing up. Nevertheless, the patients still feel safe in the sitting position, as already mentioned, if they do not want to leave the bed from the sitting position.

The easier standing up is realized because the free edge of the sitting surface is displaced significantly in the direction towards the seat area from the back of the knee. This also means a displacement of any line over which the thigh of the patient seesaws when standing up into the upright position. The farther this point is displaced towards the seat area, the easier is the standing up process. Conversely, this process becomes harder to realize the closer this point is to the back of the knee.

Without the countermeasure according to the invention, a displacement of this contact point towards the seat area would mean the patient would feel unsafe in the sitting position, especially for patients with handicaps, who are significantly limited in terms of the use of muscle force.

A very simple and reliable measure for pivoting the thigh part into the sitting position arises from the use of cam mechanics. In the simplest case, these cam mechanics can be connected to the lever arrangement that is used to pivot and to raise the lower leg part.

A very simple solution arises from using an intermediate frame, in which a shaft is supported so that it can rotate. The shaft carries on one side a lever for pivoting the lower leg part, and on the other side, cams for raising the thigh part.

The stability of the arrangement is improved when the thigh part has a cross strut, which is located at the height of the cam and which is simultaneously used as a counter surface for the cam. This enables very uniform raising of the thigh part. In particular, twisting is in this way prevented when the patient sits asymmetrically on the thigh part of the mattress frame.

Incidentally, refinements of the invention are the subject matter of the subordinate claims. By studying the embodiments, it also becomes clear that a series of modifications is possible.

An embodiment of the subject matter of the invention is shown in the drawing. Shown are:

Figure 1, the rotating and sitting-up bed according to the invention in the lying-down position, in an oblique view,

Figure 2, the bed from Figure 1 in the sitting position,

Figure 3, the bed from Figure 1 in an exploded view without covering,

Figure 4, the intermediate frame of the bed from Figure 1 in an oblique top view, and

Figure 5, an enlarged cut out from the intermediate frame in connection with a cut-out from the thigh part, in a side view.

In an oblique view, Figure 1 shows the rotating and sitting-up bed 1 according to the invention in the lying-down position, while Figure 2 illustrates the bed 1 in the sitting or reclining position.

The bed 1 has a bed surround 2 with a head part 3, a foot part 4, and also side walls 5 and 6. The side wall 5 facing the viewer is located, in the lying-down position as shown, at a distance from the floor, wherein a gap is produced between the bottom edge of the side wall 5 and the floor that enables the care provider to place the tips of his feet under the bed. The side wall 5 is supported so that it can move, and in the reclining position of the bed 1 is moved into a position pushed downwards, as can be seen in Figure 2. The special support of the side wall 5 is explained in detail, for example, in DE 199 12 937 A1.

Within the bed surround 2 there is a bed frame 7, as can be seen in Figures 2 and 3. The bed frame 7 includes a height-adjustable base 8, on whose top side a rotating articulated element 9 with a vertical rotational axis is mounted, an intermediate frame 10, and also a support frame 11 on which a mattress 12 is located. The support frame 11 is rectangular when viewed from above.

The support frame is divided into a center section 13, which is connected rigidly to the intermediate frame 11, a back section 14, which is hinged to the center section 13, a thigh section 15, which is also hinged to the center section 13, and also a lower-leg section 16. The lower-leg section 16 is hinged to the end of the thigh section 15 remote from the center section 13. The hinge axes about which the sections 14, 15, 16 can move relative to the center section 13 are horizontal. Finally, the support frame 12 also includes a foot section 17.

The center section 13 of the support frame 12 has two parallel longitudinal side rails 18 and 19, which can be seen in Figure 4. Each of these side rails 18, 19 ends at a hinge bracket for a hinge.

Each side rail 18, 19 carries inwards pointing pegs 21, on which molded rubber parts are pushed, which hold spring bars in a known way. Instead of spring bars, a plate can also be used as the contact point, which is typical for hospital beds.

The back section 14 is bordered by a side rail 22 and also by another side rail parallel to the first side rail, which cannot be seen in Figure 3 due to the perspective. The other side rail is connected to the longitudinal side rail 18 while the visible side rail 22 is hinged to the side rail 19. The two side rails 22 of the rear section 14 are connected to each other at the top end by means of a cross strut that cannot be seen in the figure. In addition, another cross strut 24 extends at the bottom side of the two side rails 22.

The thigh section 15 is also bordered by two longitudinal side rails, of which only one longitudinal side rail 25 can be seen. The other longitudinal side rail is covered by the longitudinal side rail 25. The two longitudinal side rails 25 are connected by means of a cross strut 26. The cross strut 26 extends in the vicinity of the foot end of the cross struts 26 on the bottom side.

Finally, the lower-leg section 16 is also bordered by two longitudinal side rails, of which, in turn, only the longitudinal side rail 27 can be seen in the figure. The two longitudinal side rails 27 are connected to each other at the bottom end by means of a cross strut. In addition to this strut, the two longitudinal side rails 27 are connected by a strut 29, to which the two parallel guide rails 31 are mounted which reach up to the foot end. They extend, as shown, at an angle to the longitudinal side rail 27, such that they converge in the direction towards the foot end. The separation of the two guide rails 31 is significantly smaller than the separation of the two longitudinal side rails 27. Relative to these parts, the guide rails 31 are offset by ca. 20 cm to the inside.

The foot section 17 consists of side rails 32, which are erected on the base 8 by means of struts 33.

All of the longitudinal side rails 22, 25, and 27 carry pegs pointing towards the center of the bed, corresponding to the pegs 21, in order to connect to the longitudinal side rails 22, 25, 27 by means of molded rubber parts, between which spring bars extend in a known way.

Adjacent side rails are connected to each other by means of joints 28 with horizontal axes. The axes of corresponding side rails are coaxial with each other on the two sides of the bed 1.

The sections 13, 14, 15, 16 of the support frame 11 correspond to sections of the mattress 12, which are separated there by dash-dot lines.

The height-adjustable base 8 includes an upper rectangular frame 34 and also a lower rectangular frame 35, which are connected to each other by means of a total of five toggle-joint pairs 36 and 37. The toggle-joint pairs 36, 37 are each located on a longitudinal side of the base 8, so that the corresponding toggle-joint pairs 36, 37 on the other longitudinal side cannot be seen in the side view in Figure 3.

The toggle-joint pair 36, 37 is assembled from an upper toggle lever 38 and a lower toggle lever 39. Each toggle lever 38, 39 is connected in an articulating way to the upper and lower frame 34, 35, respectively, by means of a joint 41 with horizontal axis on the associated bed side. All of the axes of the joints 41 are axis-parallel to each other. The axes of joints 41 are coaxial with the axes of the joints 41 of the toggle joint 38, 39 that cannot be seen.

The two toggle-joint pairs 36, 37 on each side of the base 8 are coupled to each other by an associated coupling strut 42. Each coupling strut 42 is connected as shown to the knee joint 43 of each toggle-joint pair 36, 37 in an articulated way. Finally, the two coupling struts 42 are connected to each other like a yoke by means of a cross strut that cannot be seen. A drive motor 44 supported on the lower frame 35 engages the cross strut.

Finally, on each side of the base, legs of diagonal coupling struts 45 connect the upper toggle lever 38 of the toggle-joint pair 37 [sic; 36] to the lower toggle lever 39 of the toggle-joint pair 36 [sic; 37].

The kinematics of the base 8 and its dimensioning are explained in detail in DE 198 54 136 A1.

The drive motor 44 involves a typical commercially available spindle motor. Worm gearing, which cannot be seen in more detail, is driven with the help of a permanently excited motor. The worm gear is connected free of rotational play with a screw spindle. A threaded nut moves on the screw spindle. A lifting tube 46, which runs coaxially in a guide tube 47, is attached to the threaded nut in a tension-proof and compression-proof way.

By setting the motor in gear with the corresponding rotational direction, the lifting tube 46 is either retracted into the guide tube 47 or pushed out of the guide tube. When the lifting tube 46 is pushed, the cross strut, which connects the coupling struts 41 [sic; 42] to each other, moves in the direction of the head of the bed. In this way, the lower toggle level 39 of each of the toggle-joint pairs 36 and 37 is raised, because all of these parts are connected to each other kinematically by means of coupling struts.

The kinematics guarantee that the upper frame 34 is always parallel to the lower frame 35. The vertical movement of the upper frame 34 results in no significant displacement of the upper frame 34 in the longitudinal direction of the bed 1 within the lifting range for which the base 8 is constructed. The resulting longitudinal movement is less than 5 mm.

The rotating articulated element 9 includes a ring 48 and also a rotating carrier 49 running in the ring 48. The ring 48 is fixed in the upper frame 34. The rotating carrier 48 includes two longitudinal side rails 51. The two longitudinal side rails 51 are parallel to each other. The rotating carrier 49 can be rotated back and forth by 90° by means of a drive motor 52.

The structure of the drive motor 52 is the same as that of the drive motor 44, which is why repeated explanation is left out.

When the rotating carrier 49 rotates, the reaction moment of the drive motor 52 is introduced into an abutment which is provided on the upper frame 34.

The structure of the intermediate frame 10 is given from Figure 4. It is assembled from two longitudinal side rails 61 and 62, which are connected to each other by means of a head-side cross strut 63. In addition, the two longitudinal side rails 61 and 62 are connected to each other, at the height of the longitudinal side rails 18, 19 of the center section 13 of the support frame 11, by means of a total of four struts 64, 65, 66, and 67. In this way, a type of open box profile, which is in the position to absorb forces originating from the brackets 68, 69, 71, and 72 when the support frame 11 is loaded with a patient, without torsion and

expansion of the distance between the longitudinal side rails 61 and 62, is produced in the region of the struts 64...67.

The brackets 68...72 are welded projecting outward on the outer side of the two longitudinal side rails 61 and 62 as shown, such that the two brackets 68, 71 align with each other just like the two brackets 69 and 72. The longitudinal axes of these pairs of brackets 68...72 are parallel to each other.

Their length is ca. 20 cm, and they carry the side rails 18 and 19 set rigidly and immovably on the free projecting ends with a spacer 73 arranged in-between. In this respect, the brackets 68...72 form the mechanically fixed connection between the support frame 11 and the intermediate frame 10.

To drive the thigh section 15 and also the lower-leg section 16, there is a shaft 74 supported at the foot end between the two longitudinal side rails 61 and 62. Parallel arms 75 and 76, which are fixed relative to each other and which are connected to each other at their free ends by a cylindrical strut 77, are mounted on this shaft 74. The strut 77 projects past the arms 76 and 75. The projecting ends are used as support pegs for two cylindrical rolls 78, of which only one is shown. The two rolls 78 run in the guide rails 31 and support the lower-leg section 16 at the corresponding position.

Towards the other side, the arms 75 and 76 project past the shaft 74 and are used as attachment points for two cam parts 79 and 80. The cam parts 79 and 80 each carry a cam surface 81, which runs part way around the shaft 74 approximately in a spiral shape. The cam surfaces 81 interact with the strut 26 on the lower side of the thigh part 15 in a way further described below.

To turn the shaft 74 and thus to raise the levers 75, 76, another lever pair 79 [sic; 79, 80], which is used as an attachment point for a connecting rod 85, sits on the shaft 74. The connecting rod 85 is connected to a lifting tube 86 of a drive motor 87. The structure of the drive motor 87 corresponds to the structure of the drive motor 44. The longitudinal axis from the composite body of the connecting rod 85 and lifting tube 86 runs parallel to the longitudinal side rail 61 in the top view, and adjacent to the longitudinal side rail 61 on its inner side. The motor 87 is supported on a bracket 88, which is reinforced relative to the longitudinal side rail 61 by means of an insert 89. The connection between the connecting rod 85 and the lifting tube 86 is hinge-like. To prevent buckling, the lifting tube 86 is guided in a special way in the region of the coupling point with the connecting rod 85.

Two short U-shaped guide rails 90 and 91 are fixed on the two lower struts 64 and 66. The two U-shaped guide rails 90 and 91 open in the direction towards each other and lie at the same height.

A fork head 88, which grips over the free end of the lifting tube 86 from the outside, is mounted on the connecting rod 85. An axle bolt, on which two rolls are supported so that they can rotate outside of the fork head 88, is guided through aligned bore holes in the fork head 88 and the end of the lifting tube 86. The rolls run in the guide rails 90 and 91. Thus, buckling of the connection point between the fork head 88 and the lifting tube 86 is effectively prevented.

The attachment of the intermediate frame 10 on the rotating carrier 64 is realized with the help of two angled flanges 92, of which only one can be seen in Figure 8 due to the perspective. The angled flanges 92 are welded to the outer side of the longitudinal side rails 61 and 62, while their other legs are flush with the bottom side of the corresponding longitudinal side rail 61, 62.

Finally, on the two cross struts 64 and 65 there is a motor abutment 94, which is mounted on a column 95 projecting downwards. The column 95 is attached with a flat side to the two struts 64 and 65. In the assembled state, it projects into the space of the rotating carrier 64. A motor, which cannot be seen and is similar to motor 44, is hinged to the motor abutment 94. This motor is supported on the strut 24 in order to raise or lower the back part 11 selectively. Of this motor, only its lifting tube 97 can be seen.

In the following explanation of the function of the bed 1, first the bed will start in the lying-down position according to Figure 1. In this position, the base 1 is moved together to a maximum, i.e., the lifting tube 61 [sic; 46] is retracted in the guide tube 62 [sic; 47]. The toggle-joint pairs 36, 37 are folded together to a maximum. The intermediate frame 10 lies in the longitudinal direction of the bed 1. The back section 14 is lowered and lies with its cross strut 24 on the longitudinal side rails 61, 62 of the intermediate frame 10. Through corresponding activation of the drive motor 87, the levers 75, 76 are brought into a position in which the lower leg section 16 runs in a straight extension of the back section 14 or the foot section 17. In this position, the non-self-actuated thigh section 15 also lies with its strut 26 on the two longitudinal side rails 61 and 62.

The patient can selectively raise the back section 14. For this purpose, he sets the corresponding drive motor in gear by means of a hand control. Its lifting tube 97 is moved outwards and presses the back section 14 upwards.

The lower-leg section 16 is raised when the user sets the motor 87 in gear. The lifting tube 86 is moved outwards and pushes the connecting rod 85 in the direction towards the shaft 74. This is turned in order to pivot the levers 75, 76 upwards and to press the lower-leg part 16 up. Through suitable stops in the guides 31, the lower-leg section 16 is simultaneously pulled towards the center section 13 when the levers 75, 76 pivot upwards. Consequently, the thigh section 15 is also arranged diagonally upwards, as shown in Figure 3.

If the patient would like to be brought by the bed 1 into a position similar to a healthy person sitting on the edge of the bed, he first brings the lower leg and the thigh sections 15, 16 into the position according to Figure 3. In addition, the back section 14 is brought into a position of ca. 45°, so that for subsequent rotating, there is not excessive projection past the outlines of the bed. As soon as the support frame 11 has been adjusted accordingly, the base 8 moves up until the bottom side of the intermediate frame 10 can rotate freely over the upper edge of the two side walls 5, 6.

When this position is reached, the lifting motor 57 is stopped and the rotary motor 97 assigned to the rotating articulated element 9 is set in gear. Its lifting tube moves in and turns the intermediate frame 10, together with the support frame 11 located on this frame, by 90° either to the left or to the right, depending on which abutment the rotary motor 97 is articulated to.

As soon as the final rotating position has been reached, the lifting motor 57 is set in gear again in order to move the base 8 together into its smallest arrangement. For the downwards movement, the bottom side of the intermediate frame 10 engages with the top side of the side wall 5 and presses it downwards.

After reaching the bottom-most position, the motor 87 is set in gear, such that the lifting tube 86 is pulled into the associated guide tube. This movement pulls the connecting rod 83 back, whereby the levers 75, 76 are pivoted downwards. This downwards pivoting of the levers 75, 76 has the effect that the foot section is also pivoted downwards until it reaches the final position from Figure 2. When the shaft 74 rotates, the cam parts 79 and 80 are turned upwards and engage with the strut 26. Due to the profile of the cam surface 81, continued rotation raises the strut 26, which pivots the thigh part 15 upwards about the joint between the

side rails 25 and 19. In the final position, the thigh part 15 is raised in the region of the back of the knee of the patient by ca. 2 cm to 5 cm. A flat sitting depression is produced, which makes the patient feel safe in the sitting position.

When the lower-leg part 16 is raised again, the cam parts 79 and 80 rotate downwards away from the strut 26. The thigh part 15 is lowered into the horizontal position.

Finally, the patient can adjust the back section 14 more or less steeply as desired.

As follows from the description of the function, the length of the lower-leg section 16 in the chair or recliner position, measured starting at the upper edge of the mattress 12, may not be longer than the length of the lower leg for a normal sized person. Otherwise, he could not reach the floor with the soles of his feet.

As mentioned, the proportioning of the thigh section 15 and lower-leg section 16 must be adapted to human anatomy, which requires no special explanation. For the normal lying-down position, the lower-leg section 16 would be too short, which is why the foot section 17 is provided, which carries a separate mattress section.

With the help of the bed 1, a patient can be brought from the lying-down position into a sitting position perpendicular to the bed without any exertion by himself and without having to rely on the help of a care provider.

He can also be brought back from this position into the lying-down position by performing the sequence of movements described above in reverse.

A rotating and sitting-up bed is assembled from a height-adjustable base and a support frame, which is connected to the base by means of a rotating articulated element. With the help of the rotating articulated element, the support frame can be rotated by 90 degrees relative to the vertical axis.

The support frame is divided into a back section, a center section, a thigh section, and a lower-leg section. In the rotated position, the support frame can fold into a Z shape, wherein the back part extends upwards starting from the center part, and the lower-leg part hangs downwards from the thigh part. In addition, by means of a crank mechanism, the thigh part is raised by a few cm at its front edge, which is adjacent to the back of the knee of the patient.

Claims

1. Hospital and sitting-up bed (1) with a height-adjustable base (8), with a support frame (11), which is divided into a center part (13), a back part (14) connected to the center